

## Platform Engineering:

With a strong background in developing world class enterprise platforms, we are well positioned to help Metaverse platform providers augment their product engineering teams. Our expertise includes core platform development, content design, Infrastructure and quality assurance. We work with customers to create tools and frameworks across different layers of the ecosystem leveraging 3D engines, spatial mapping, analytics, security, and Industry 4.0 systems.

The Metaverse is an exciting playground of new ideas where new-age technologies are laying the foundation of an ecosystem that will fundamentally alter the way we live, work, and communicate. It would be imperative for businesses to get a head start in defining their vision for the Metaverse, identifying the upside to their customers and stakeholders, and putting in place the requisite investments. As a Born Digital, Born Agile, next-generation technology services company, we are here to help you every step of the way.



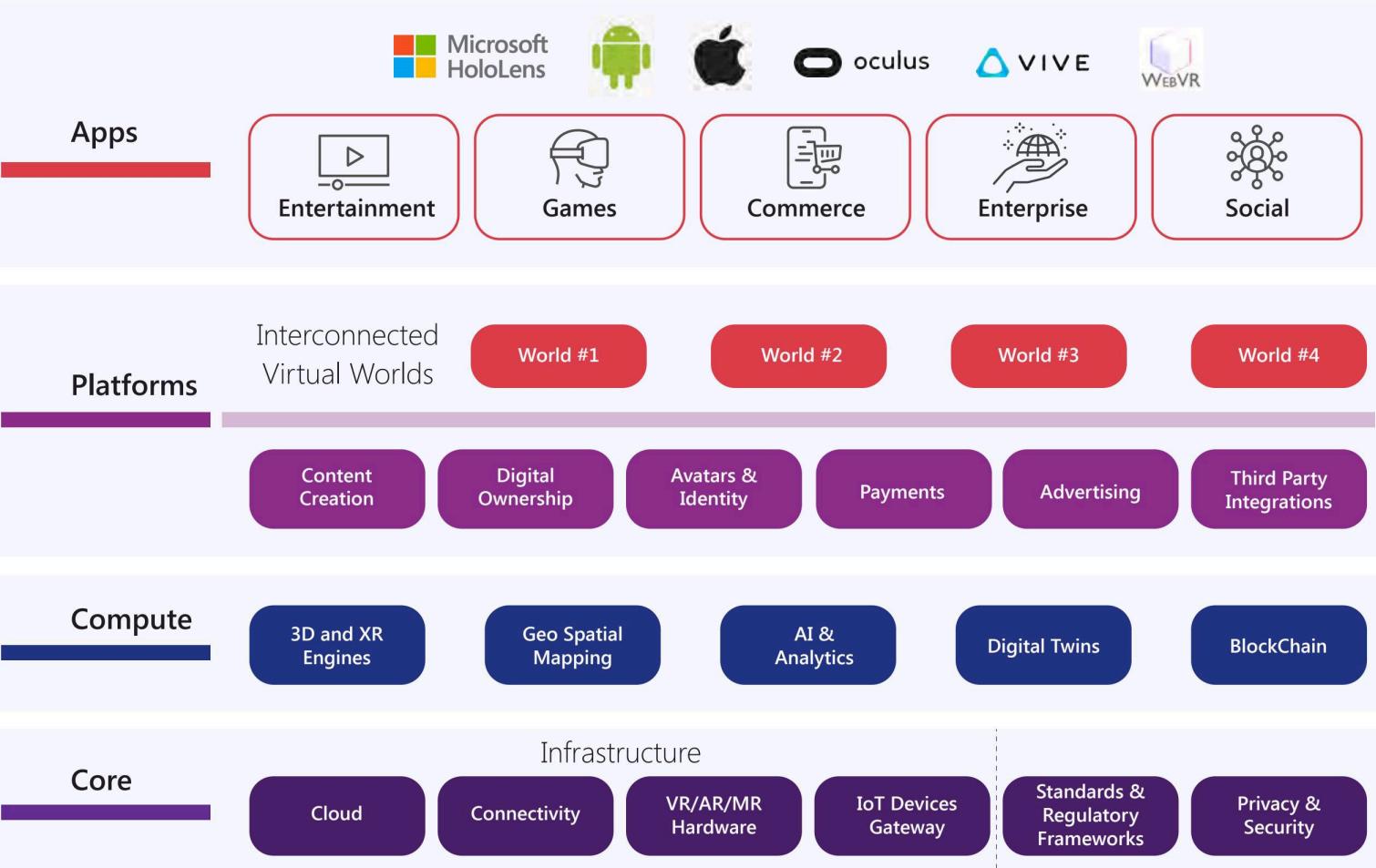


# HYPOTHETICAL STACK

The evolution of the Metaverse will largely be determined by infrastructure, standards, privacy, and security. With advancements in 5G, Cloud, Hardware and IoT, the tech infrastructure, required to support multiple-use cases of the Metaverse, is rapidly taking shape. However, standards, privacy, and security protocols are yet to be developed.

Spatial Computing (an umbrella term used to refer to interactions in virtual, augmented, and mixed reality) lets users interact with each other

and with digital objects in persistent connected spaces. Platforms such as AWS, Azure, Unity, Apple are also in the process of creating the necessary toolkits and services to meet this goal. While blockchain technology is increasingly being adopted for alternate payments using cryptocurrencies and digital ownership using NFTs (Non-Fungible Tokens), it still needs to address the issues around scalability and interoperability. Blockchain as an enabler is a critical component for Metaverse to establish trust across different stakeholders.



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Platforms are still at a stage of infancy and many companies are trying to find the right building blocks needed to tap into the enormous potential of the Metaverse. Companies such as Roblox, Decentraland, Sandbox have opened up

their platforms to create and host different apps in their simulated environments. These platforms shall be interoperable for users to create and carry digital assets and transactions across multiple virtual worlds.

AN OVERVIEW OF THE

# METAVERSE

ITS INCREDIBLE POTENTIAL &  
EMERGING BUSINESS OPPORTUNITIES



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- Metaverse – Fueled by Technology
- An Overview of the Metaverse Ecosystem
- Hypothetical Stack
- Opportunities in the Metaverse
- Challenges posed by the Metaverse
- Current State of the Metaverse
- How Happiest Minds can help realize your Metaverse vision

# AUTHOR BIOS



## Ritesh Gupta

### VP & CTO – Product Engineering Services

Ritesh Gupta is the VP & CTO of Product Engineering Services at Happiest Minds. He is responsible for defining the technology direction for the product engineering business and working closely with practice heads in creating robust offerings that resonate with the market.

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## [Business@happiestminds.com](mailto:Business@happiestminds.com)

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# INTRODUCTION



Metaverse has become a buzzword in the tech industry. Not a single day goes by without a mention of it in the media, especially around investments, startups building components, new platforms being announced and large companies entering this world of digital engagement. There is undeniably a huge momentum of an almost real 3D virtual world, and the clarion call was perhaps Facebook rebranding itself as Meta which will perhaps be remembered as a red letter moment in the evolution of the Metaverse.

While the Metaverse can seem like a fairly new concept, the origin of Metaverse dates back to 1992 when Neal Stephenson coined the term in his science-fiction novel "Snow Crash" and early glimpses of it showed up a decade back from Roblox. For very obvious reasons, the reactions in the market were mixed. For instance, Fortnite, developed by Epic Games, started out as a successful 4-player game but soon ended up becoming one of the coolest online hangouts for Gen-Z. The resultant hype caused it to pivot towards becoming a social platform that recently hosted virtual concerts of Ariana Grande and Travis Scott, not surprisingly, attended by millions of music lovers in virtual avatars.

Metaverse can be best described as persistent, connected virtual realities where people work, play, and socialize: anytime, anywhere, and from any device. It is the convergence of the physical, augmented, and virtual reality where users can interact with each other in real-time scenarios. It's a revolutionary form of digital interaction with endless, untapped potential that holds massive opportunities in the marketplace.

This immersive virtual world that Metaverse aims to bring to us will not just be limited to user engagement but can be envisaged as an extension of the real world where organizations and people come together to invest, build, and trade products and services. It is the next-generation internet that will transport us to an immersive and hyper-realistic digital world.

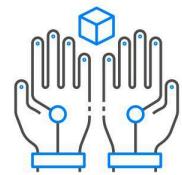
While the concept is not fully evolved yet, it is certain that new-age technologies such as AR/VR/MR, IoT, AI, 5G and Blockchain will become an enabling force to create a full-blown interconnected virtual world. It is no wonder that companies around the globe have placed big bets on it.



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# HOW HAPPIEST MINDS CAN HELP REALIZE YOUR METAVERSE VISION



Happiest Minds has deep technical expertise across various levels of the Metaverse ecosystem. With focus on emerging technologies like artificial intelligence (AI), 5G, Blockchain, virtual reality (VR), augmented reality (AR), and agile practices, we can help you articulate and realize your metaverse vision.

## Product Strategy:

We work with customers to explore industry specific use cases that are aligned to their unique business needs and Metaverse vision. This involves assessing technology feasibility, evaluating and identify the right Metaverse platform and tools, creating product roadmaps and solution architectures that generate value immediately as well as in the long run.



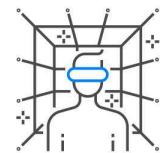
## Design and Build Metaverse Applications

We have extensive experience in building intuitive and engaging applications across different industries which translates well to both centralized and decentralized Metaverse platforms. We have expertise in creating synthetic 3D environments with custom avatars that can support different devices such as XR headsets, mobile devices, and many others. We can enable customers to build or integrate their apps with Metaverse Ecosystem components to ensure a seamless experience across platforms. Some of our capabilities include –

- NFT based marketplaces for digital ownership
- XR based analytics
- Centralized and decentralized identity management
- Integration with enterprise systems
- Create synthetic environments from physical environments and custom avatars using AI
- Integration with digital twins



# CHALLENGES POSED BY THE METAVERSE



While anything associated with the Metaverse is buzzing, there are certain challenges yet to be addressed to realize its fullest potential:

## 01 Maturity of VR/AR/MR Headsets:

The cost of Oculus Quest2 has drastically reduced. However, the price of HoloLens, and VR cameras can still be prohibitive. There are also health concerns associated with headsets, such as nausea and unresolved challenges for the visually impaired.

## 02 Scalability:

New tools and platforms have to be created to ensure seamless content migration to virtual worlds. Also, tools will need to be designed to create synthetic environments that simulate the real world.

## 03 Regulations:

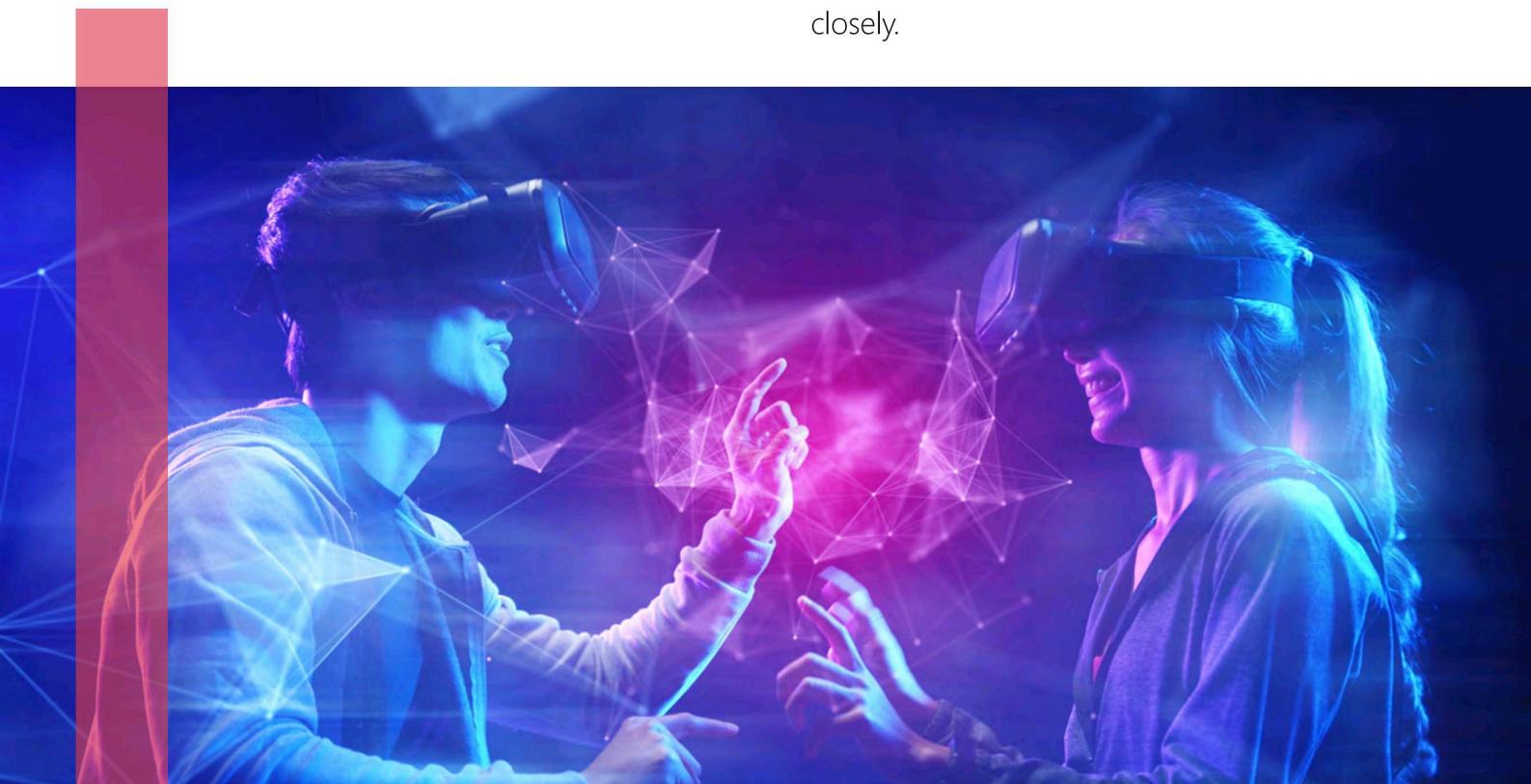
Existing legal frameworks need to be adapted in the virtual world to address digital justice issues.

## 04 Interoperability:

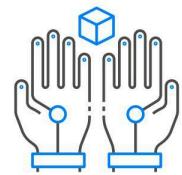
Currently, all platforms are siloed. This restricts the much larger vision of Metaverse that needs to be looked into to facilitate interoperability.

## 05 Privacy:

Deepfakes, hacked avatars, brand safety, and manipulated objects are just a few examples of malicious behavior marketers will have to monitor closely.



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# CURRENT STATE OF THE METAVERSE



Area	Need	Current State	Players
Connectivity	Low latency and high-speed network with high frame rates above 90 fps.	5G has evolved and is almost mainstream. Trials are underway to simulate virtual environments with 5G networks.	Telcos
Hardware	Compact and cost effective XR headsets & haptic devices.	Headsets such as Oculus, HoloLens are used to simulate AR/VR use cases in Healthcare, Education and Industrial Segments. Health related issues, such as nausea, are still a concern.	Facebook, Microsoft, Apple, HTC
Edge Infrastructure	Edge based processing to reduce latency.		
Decentralization	Decentralized infrastructure for identity, digital ownership and payments.	Emergence of public and private Blockchains, self-sovereign identity networks and NFTs (Non-Fungible Tokens).	Ethereum, Hyperledger, Decentraland, Sandbox
Artificial Intelligence	Automated synthetic environments simulating the physical world, VR based analytics, autonomous avatars.	Emergence of generative AI to create simulated environments, autonomous systems and VR based analytics platforms.	
Avatars	Photorealistic avatar to mimic behavior of users in the virtual world.	Virtual beings and meta human based platforms are evolving.  LCAP platforms are emerging to create stories in virtual worlds.	Unreal, Epic Games
Security & Regulations	Regulations to safeguard users and environments in a virtual world.  Customer privacy and data protection to ensure that users, brands, and objects are secured in both physical and virtual worlds.	No significant developments yet.	
Metaverse Platforms	Easy to use platform to create apps and interact with virtual worlds.  Ability to carry content, payments and avatars seamlessly across different virtual environments.	Emerge of decentralized and centralized Metaverse platforms.	Microsoft, Nvidia, Ninantic, Dencentraland, Facebook

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Along with this, the adoption of Metaverse depends on the adoption of the apps. However, the delay in the development of the App ecosystem poses a challenge. Nonetheless, there are early glimpses of apps focused on buying and selling virtual lands, virtual conferences and play to earn games.

That said, most importantly, to be truly immersive, avatars need to look and behave close to real beings. So, while there are solutions to create them and collaborate in a virtual world, there is still a lot of work needed to achieve a seamless shift between the real and virtual states.

## OPPORTUNITIES IN THE METAVERSE



Metaverse presents before us a plethora of opportunities. These have the potential to cause enormous disruptions across industries. As every organization eventually tries to create its presence in the virtual world, what can be accomplished is only limited by one's imagination. Perhaps, we can only expect the unimaginable.

However, from a more pragmatic standpoint, some of the early use cases which have gained traction are: